DYNAMICS OF MODEL HYDRAULIC FRACTURING LIQUID STUDIED BY TWO-DIMENSIONAL INFRARED SPECTROSCOPY

KIM DALEY, KEVIN J KUBARYCH, *Department of Chemistry, University of Michigan, Ann Arbor, MI, USA*.

The technique of two-dimensional infrared (2DIR) spectroscopy is used to expose the chemical dynamics of various concentrations of polymers and their monomers in heterogeneous mixtures. An environmentally relevant heterogeneous mixture, which inspires this study, is hydraulic fracturing liquid (HFL). Hydraulic fracking is a technique used to extract natural gas from shale deposits. HFL consists of mostly water, proppant (sand), an emulsifier (guar), and other chemicals specific to the drilling site. Utilizing a metal carbonyl as a probe, we observe the spectral dynamics of the polymer, guar, and its monomer, mannose, and compare the results to see how hydration dynamics change with varying concentration. Another polymer, Ficoll, and its monomer, sucrose, are also compared to see how polymer size affects hydration dynamics. The two results are as follows: (1) Guar experiences collective hydration at high concentrations, where as mannose experiences independent hydration; (2) no collective hydration is observed for Ficoll in the same concentration range as guar, possibly due to polymer shape and size. HFL experiences extremely high pressure during natural gas removal, so future studies will focus on how increased pressure affects the hydration dynamics of polymers and monomers.